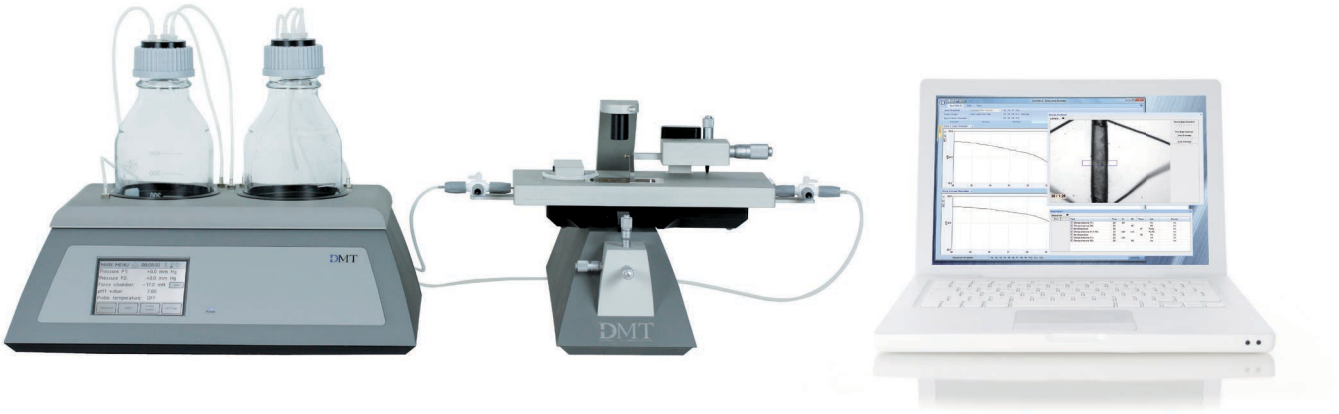
DMT
DANISH MYO TECHNOLOGY

PRESSURE MYOGRAPH SYSTEMS
110P AND 120CP
USER MANUAL



User Manual
Version 2.0

TRADEMARKS

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This document was, as far as possible, accurate at the time of printing.
Changes may have been made to the software and hardware it describes since then.
New information may be supplied separately.

This documentation is provided with a
Pressure Myograph System - 110P/120CP

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SAFETY

The Pressure Myograph System has been designed for use only in teaching and research applications. It is not intended for clinical or critical life-care use and should never be used for these purposes. Nor for the prevention, diagnosis, curing, treatment, or alleviation of disease, injury, or handicap.

- Do not open the apparatus: the internal electronics pose a risk of electric shock.
- Do not use this apparatus near water.
- To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture. Objects filled with liquids should not be placed on the apparatus.
- Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
- Only use secure industry standard connectors and tubing for pressure connections. Faults, defects and mistakes due to wrong connections void warranty. We are not accountable for results and mistakes due to inappropriate pressure hookup.
- Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus that produce heat.
- Only use attachments and accessories specified by the manufacturer.
- Unplug this apparatus during lightning storms or when unused for long periods of time.

The Pressure Myograph System is delivered with an external 100-240VAC to 24VDC adapter.

Protect the power adapter and cord from being walked on or pinched. Particularly at power plugs and the point where they connect to the apparatus.

Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way; such as, the power-supply cord or plug is damaged, liquid has spilled onto or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

EC DECLARATION OF CONFORMITY

Danish Myo Technology A/S
Certify and declare that the following apparatus:

Pressure Myograph System - DMT110P, DMT120CP
Restrictive use: Only for laboratory use.

Manufactured by:
Danish Myo Technology A/S
Skejbyparken 152
8200 Aarhus N.
Denmark

Conforms with the essential requirements of the EMC Directive 2004/108/EC.
Based on the following specifications applied by:
EN 61326-1:2006
EN 61326-2-6:2006
EN 61326-2-6/Corr.:2007

And with the LVD Directive 2006/95/EC.
Based on the following specifications applied by:
EN 61010-1:2010
EN 61010-2-030:2010

General warnings regarding EMC:
Do not use this device in close proximity to sources of strong electromagnetic radiation (e.g. unshielded intentional RF sources), as these may interfere with the proper operation.

UNPACKING THE PRESSURE MYOGRAPH SYSTEM

Please take a few minutes to carefully inspect your new Pressure Myograph System for damage, which may have occurred during handling and shipping. If you suspect any kind of damage, please contact us immediately and the matter will be pursued as soon as possible. If the packing material appears damaged, please retain it until a possible claim has been settled.

We recommend that you store the packing material for any possible future transport of the Pressure Myograph System. In case of transport, and the original packing material is unavailable, please contact the DMT Sales Department for advice and packing instructions. After unpacking your new Pressure Myograph System, please use the following list to check that the system is complete:

Pressure Interface
- Pressure Interface-to-chamber cable with a temperature probe
- Power adapter (the shape of the AC plug varies by country; be sure that the plug has the right shape for your location)
- USB cables for PC connection.
- Atlas Copco Cablair hose for main pressure supply
- Two 500ml Schott Duran Bottles with specially designed screw caps

Pressure Myograph (110P or 120CP)
- Force calibration kit (including “bridge”, “balance” and 2 gram weight)
- Resistance tube shunt (calibration tube)
- Two glass cannulas
- Chamber cover

Riester “Big Ben” Pressure Manometer

Peristaltic pump for superfusion flow (optional):
Watson Marlow peristaltic pump

FlowMeter – 162FM (optional)
- MyoFlow™ FlowMeter software including drivers (CD-ROM)
- User manual “FlowMeter – 162FM”

Microscope (optional)
- DMT inverted Microscope, Inverted Zeiss, Olympus, Nikon or Motic etc.

Accessories:
- Allen key
- Spare screws
- Small screwdriver
- Suture wire
- Tube of high-vacuum grease
- Tube of grease for linear slides
- Silicone tubing: internal diameter 1mm

Computer, hardware, software & manuals:
- USB digital camera (optional)
- Computer (optional)
- CD with MyoVIEW software program (optional)
- CD with User Manual for Pressure Myograph Systems and User Guide for 110P or 120CP

CHAPTER 1 - SYSTEM OVERVIEW

1.1 Pressure Interface

Figure 1.1 *Pressure Interface - front*

Figure 1.2 *Pressure Interface - rear*

1.2 Pressure Myographs

1.2.1 Pressure Myograph - 110P

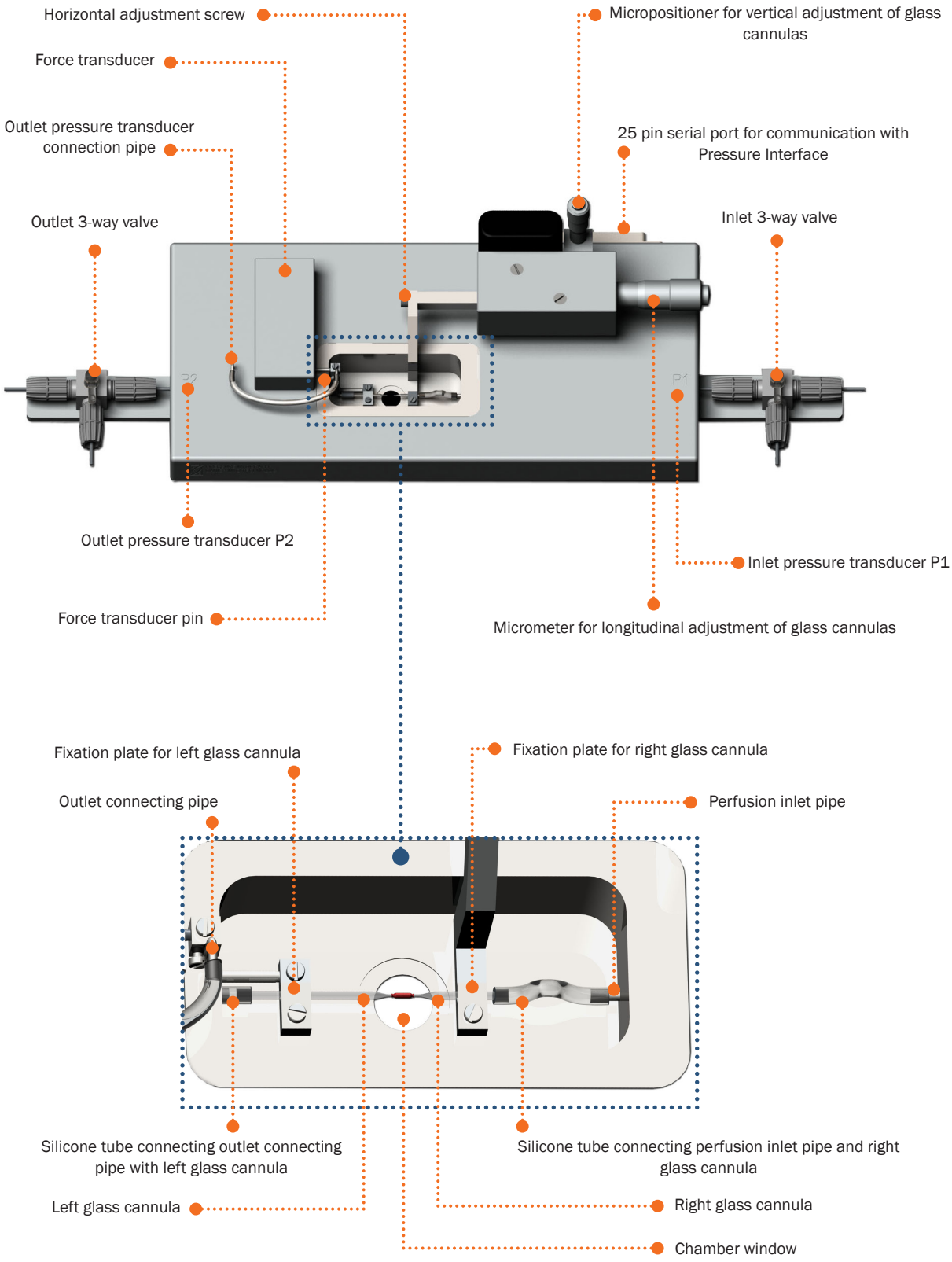

Horizontal adjustment screw
Micropositioner for vertical adjustment of glass cannulas
Force transducer
Outlet pressure transducer connection pipe
25 pin serial port for communication with Pressure Interface
Outlet 3-way valve
Inlet 3-way valve
Outlet pressure transducer P2
Inlet pressure transducer P1
Force transducer pin
Micrometer for longitudinal adjustment of glass cannulas
Fixation plate for left glass cannula
Fixation plate for right glass cannula
Outlet connecting pipe
Perfusion inlet pipe
Silicone tube connecting outlet connecting pipe with left glass cannula
Silicone tube connecting perfusion inlet pipe and right glass cannula
Left glass cannula
Right glass cannula
Chamber window

Figure 1.3 *Pressure Myograph - 110P with close-up of the chamber*

1.2.2 Confocal Pressure Myograph - 120CP

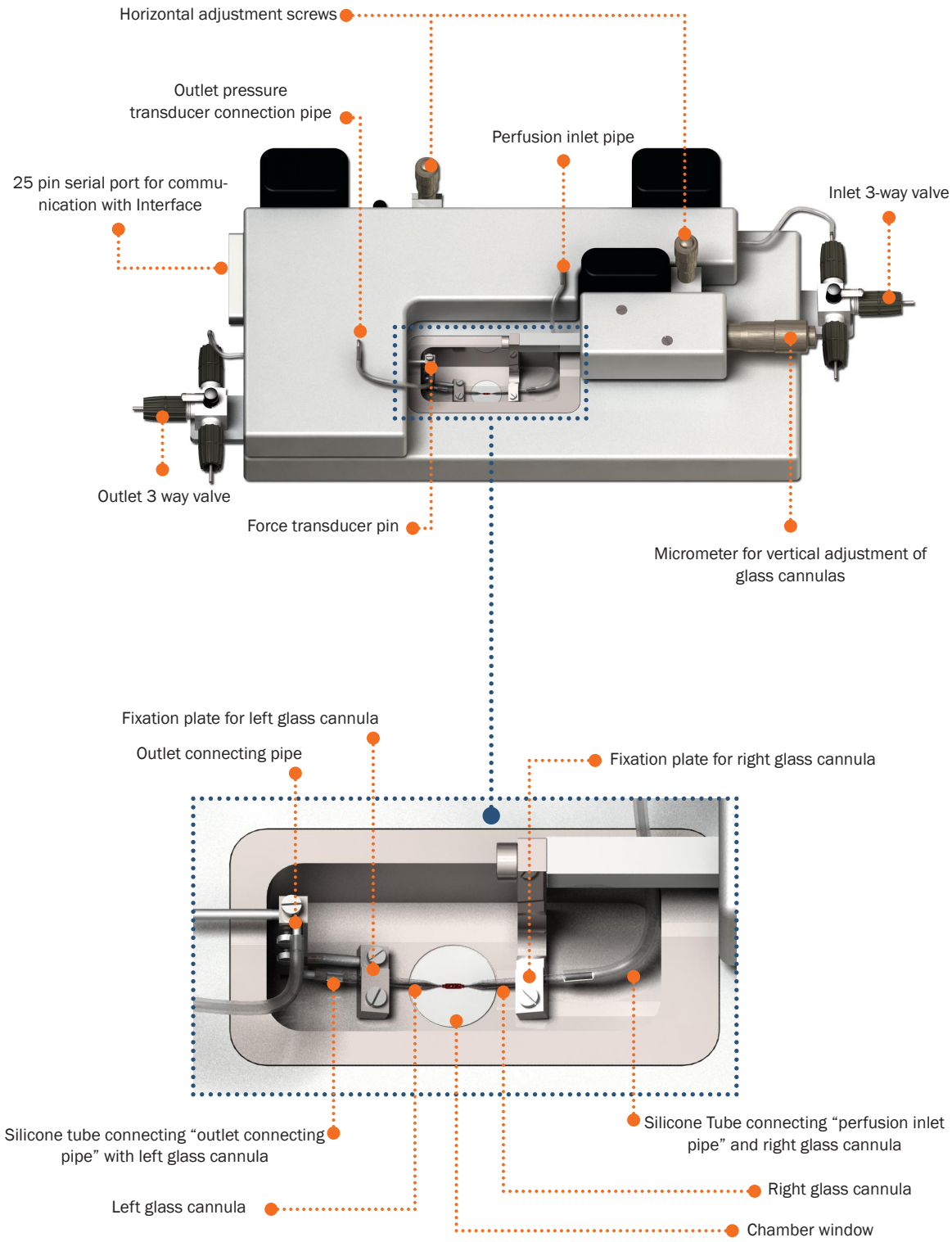

Horizontal adjustment screws
Outlet pressure transducer connection pipe
Perfusion inlet pipe
25 pin serial port for communication with Interface
Inlet 3-way valve
Outlet 3 way valve
Force transducer pin
Micrometer for vertical adjustment of glass cannulas
Fixation plate for left glass cannula
Outlet connecting pipe
Fixation plate for right glass cannula
Silicone tube connecting “outlet connecting pipe” with left glass cannula
Silicone Tube connecting “perfusion inlet pipe” and right glass cannula
Left glass cannula
Right glass cannula
Chamber window

Figure 1.4 *Confocal Pressure Myograph - 120CP with close-up detail of the chamber*

CHAPTER 2 - SETTING UP

2.1 Setting up the complete Pressure Myograph System

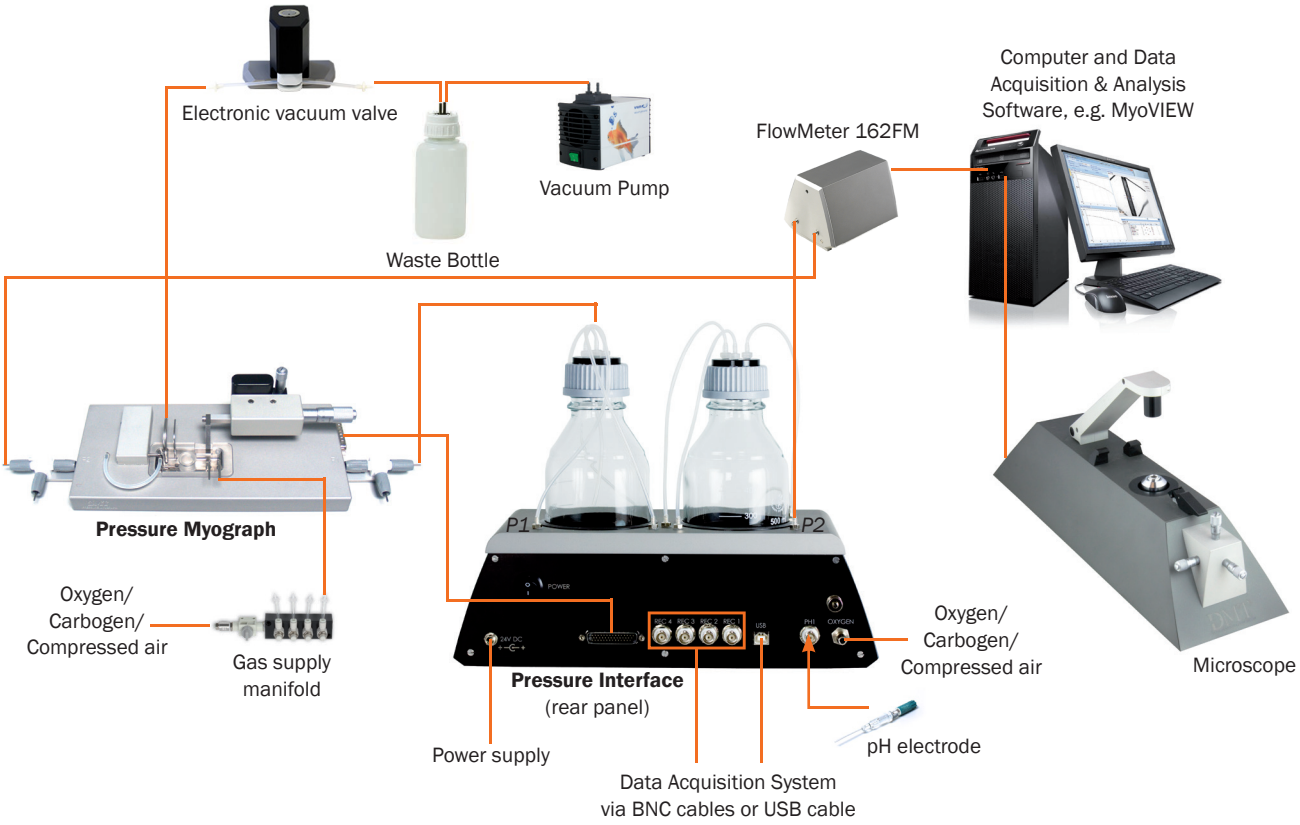


Figure 2.1 *Example of a complete set-up of Pressure Myograph System with DMT inverted Microscope*

Figure 2.1 is an example of a complete set-up for the Pressure Myograph System. The overview includes optional equipment such as a peristaltic pump to enable superfusion flow and pH probes for measuring pH in the superfusion buffer. Also the overview also includes the DMT Flowmeter - 162FM. The Flowmeter enables flow measurements in the range of 15-4000µl/min. A detailed step-by-step description is provided in the remaining sections of chapter 2.

The Pressure Myograph System will work with a range of different microscopes; the DMT Microscope, Zeiss Axio Vert A1, Nikon TS-100F, Motic AE2000 or your own choice of inverted microscope of choice.

NOTE
THE MICROSCOPE IS ESSENTIAL FOR THE DIMENSIONAL ANALYSIS OF THE MOUNTED VESSELS.

The DMT Microscope is a standard inverted microscope with a built-in digital CCD USB camera. The DMT Microscope is very effective and recommended in setups requiring standard image analysis.

The Zeiss Axio vert A1 is an inverted microscope that provides the highest degree of flexibility in image analysis. The Zeiss Axio vert A1, a Nikon TS-100F and Motic AE 2000 enable the use of a wide range of objectives and facilitate sophisticated fluorescence techniques.

Contact the DMT Sales Department for further product information and prices on any optional equipment, including microscopes.

2.2 Setting up step-by-step

This section describes how to connect the cables in the Pressure Myograph System as illustrated in figure 2.1.

NOTE
BEFORE PROCEEDING SETTING UP STEP-BY STEP MAKE SURE THAT THE PRESSURE INTERFACE, THE MICROSCOPE AND THE COMPUTER ARE SWITCHED OFF.

1. **Pressure Myograph to Pressure Interface connection:**
   Connect the Pressure Myograph to the Pressure Interface by using the grey 25/44-pin connection cable. Then connect the cable with the temperature probe to the Pressure Myograph.

2. **Pressure Interface to computer connection:**
   Connect the Pressure Interface to the computer with the USB cable, from the back panel of the Pressure Interface to the USB port on the computer.

3. **Pressure Interface and oxygen supply connection:**
   Connect the "Oxygen" inlet on the back of the Pressure Interface to an adjustable oxygen supply using the "Atlas Copco Cablair hose" delivered with the Pressure Myograph System.

   IMPORTANT MAKE SURE THAT THE HOSE IS SECURELY FASTENED TO THE "OXYGEN" INLET USING THE HOSE CLIP. THE PRESSURE FROM THE OXYGEN SUPPLY MUST NOT EXCEED 1.0 BAR!

4. **Microscope/camera to computer connection:**
   A. **DMT Inverted Microscope**
      Inside the DMT Microscope there is a USB camera wired to a USB cable and one USB cable to power the microscope light. Connect the two USB cables from the DMT Microscope to the computer USB ports.

   B. **Other microscope**;
      Zeiss Axio vert A1, Nikon TS-100F, Motic AE 2000 etc. Connect the USB cable from the USB camera mounted on the microscope to the computer USB port.

5. **Pressure Interface to external Data Acquisition System connection (optional):**
   If you have not obtained the MyoVIEW software the four BNC ports on the rear of the Pressure Interface enables connection of an external data acquisition system for recording inlet pressure P1, outlet pressure P2, longitudinal force, probe temperature, chamber temperature, flow ON/OFF, pressure ON/OFF, pH1 value and (Optional Dig out1, Dig out2, Dig in1 dig in2).

   NOTE I
   IF YOU HAVE PURCHASED A COMPUTER FROM DMT WITH YOUR PRESSURE MYOGRAPH SYSTEM THEN THE MYOVIEW DATA ACQUISITION SOFTWARE HAS ALREADY BEEN INSTALLED WITH DRIVERS FOR THE DIGITAL USB CAMERA. FOLLOW THE NEXT PROCEDURE TO SETUP THE PRESSURE MYOGRAPH SYSTEM.

   NOTE II
   IF YOU HAVE NOT PURCHASED A COMPUTER FROM DMT FOLLOW THE MYOVIEW QUICK INSTALLATION GUIDE TO INSTALL MYOVIEW ON YOUR OWN COMPUTER.

6. **Turn on the power:**
   Turn the main power to the Pressure Interface on at the power switch. Then turn on the computer and the Pressure Myograph System is now ready to be used with MyoVIEW Data Acquisition Software.

2.3 The first force and pressure calibrations

Prior to shipping the Pressure Myograph System has gone through two days of continuous testing, including final force and pressure calibrations. However in order to ensure that the Pressure Myograph System is working at highest performance, DMT recommends that new force and pressure calibrations are performed before the first use. The force and pressure calibration procedures are described in detail in chapter 3.7.1.

2.4 External Pressure Myograph connections

This section illustrates how to connect the perfusion circuit, the superfusion circuit, oxygen supply, pressure supply and suction device on to the Pressure Myograph.

2.4.1 Connecting perfusion flow

The perfusion flow is controlled by the Pressure Interface. Instructions on how to control the perfusion flow are provided in chapter 3.4. To connect the Pressure Interface to the Pressure Myograph, use the silicone tube (internal diameter 1mm) delivered with the Pressure Myograph System.

- Connect the “perfusion inlet” at P1 on the Pressure Myograph (see figure 2.2 and 2.3 for Pressure Myograph - 110P and Confocal Pressure Myograph - 120CP, respectively) to the P1 outlet on the cap of the Pressure Interface bottle (see figure 2.4).

- Connect the “perfusion outlet” at P2 on the Pressure Myograph (see figure 2.2 and 2.3 for Pressure Myograph - 110P and Confocal Pressure Myograph - 120CP, respectively) to the P2 inlet on the Pressure Interface (see figure 2.4).

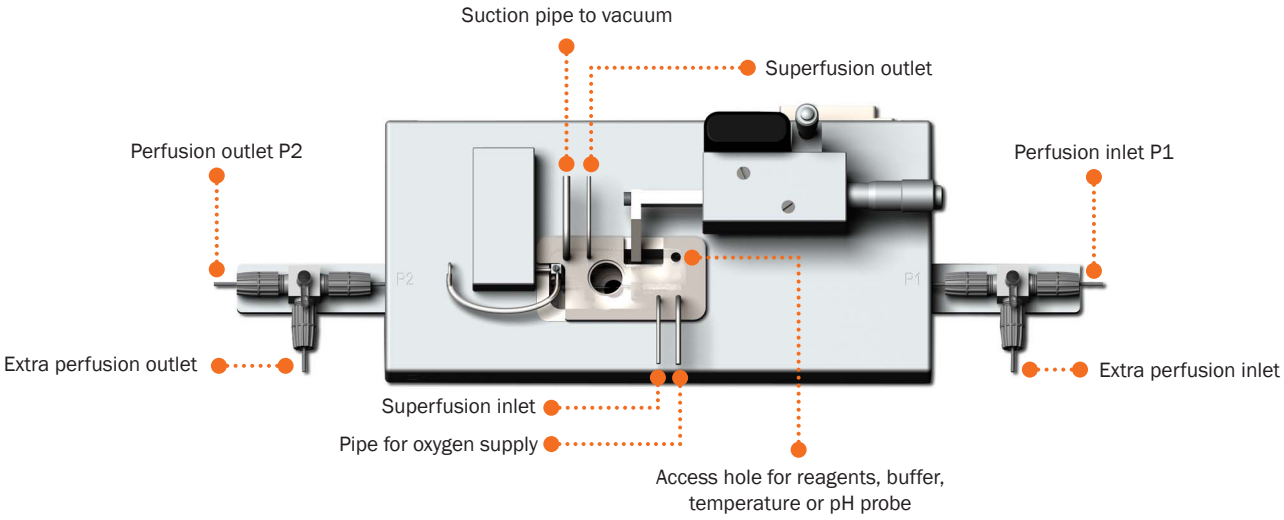


Figure 2.2 *External Pressure Myograph connections for 110P*

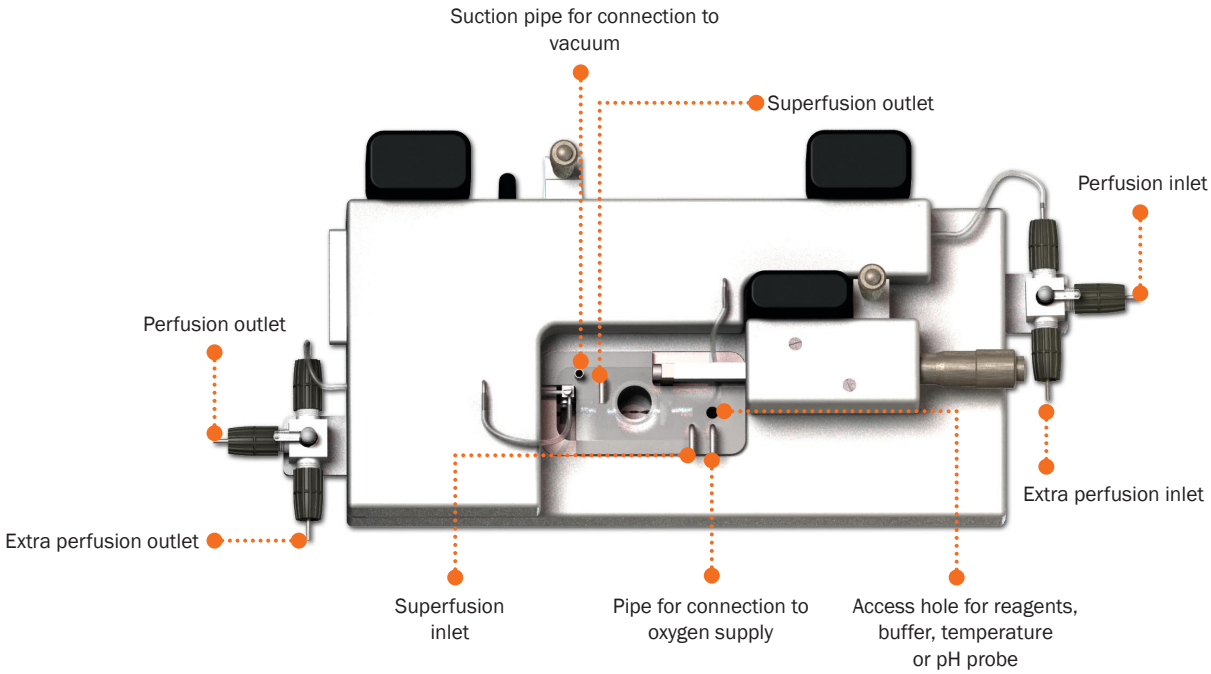


Figure 2.3 *External Pressure Myograph connections for 120CP*

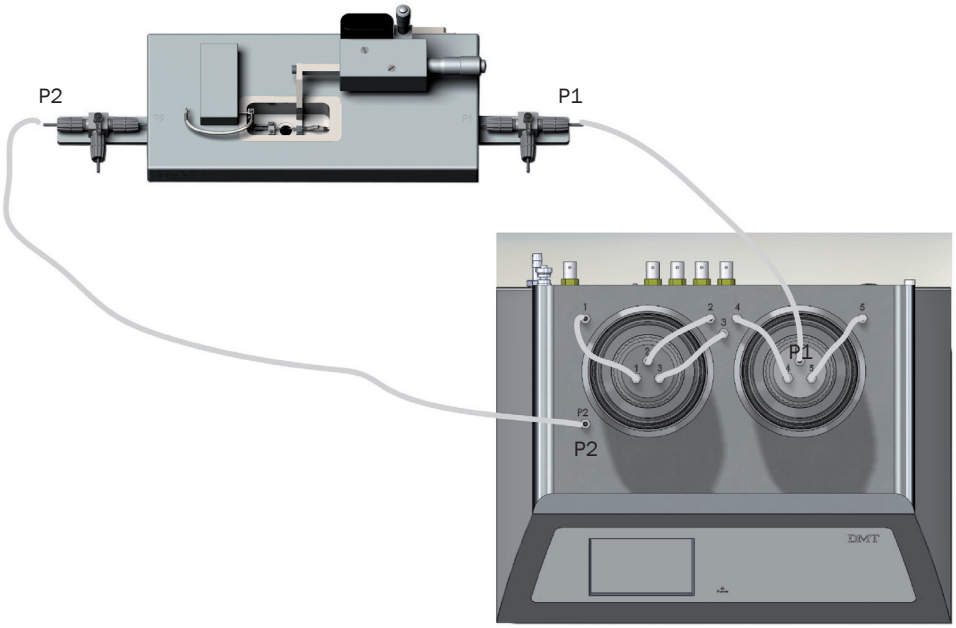


Figure 2.4 *Pressure Interface tube connections with Pressure Myograph - Example with Pressure Myograph - 110P*

NOTE I
TO FILL THE TUBING AND AVOID AIR BUBBLES, MOUNT THE CALIBRATION SHUNT (RESISTANCE TUBE) AS DESCRIBED IN CHAPTER 3.7.2.1. FILL THE P1 SCHOTT BOTTLE WITH A MAXIMUM OF 400 ML OF BUFFER. IN THE PRESSURE INTERFACE MENU SET THE PRESSURE P1 AND P2 AS FOLLOW:

P1 = 150mm Hg
P2 = 70mm Hg
Set the Pressure ON
Set Flow ON

Let the pressure regulator run until no air bubbles are visible in the perfusion circuit.

IMPORTANT
NEVER RUN AIR BUBBLES THROUGH A VESSEL AS THIS MAY DAMAGE IT.

NOTE II
NEVER FILL THE BUFFER BOTTLE WITH MORE THAN 400 ML OF BUFFER AS HIGHER VOLUMES MAKES PRECISE CONTROL OF THE PRESSURE MORE DIFFICULT.

2.4.2 Extra perfusion inlet/outlet

The extra perfusion inlet/outlet 3-way valves on the Pressure Myograph allow the introduction of special agents or reagents to the perfusion circuit during an experiment. They are situated at P1 and P2 on the Pressure Myograph and the small handle on top of the valves controls the flow direction. See figure 2.5.

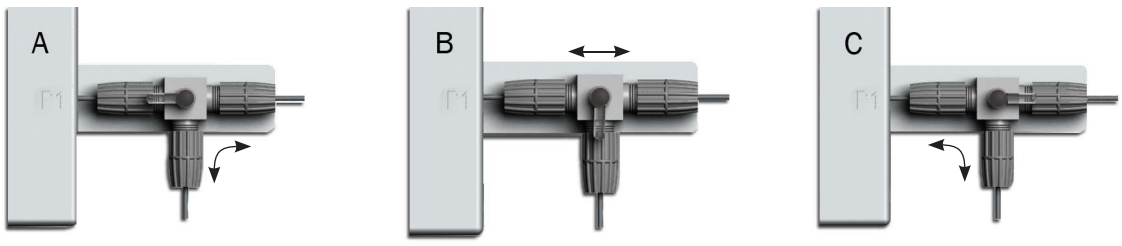


Figure 2.5 *3-way valve flow settings at P1*

2.4.3 Connecting superfusion flow (optional)

Creating a superfusion flow in the Pressure Myograph chamber requires an external peristaltic pump, which is not part of the basic Pressure Myograph System. Contact DMT for further information about recommended perfusion pump models, specifications and prices. The superfusion circuit is connected to the Pressure Myograph as illustrated in figure 2.1.

2.4.4 Connecting the Flowmeter – 162FM (optional)

The FlowMeter – 162FM is optional for flow measurements in the range of 15 – 4000µl/min. The FlowMeter is easily combined with any Pressure Myograph System as illustrated in figure 2.1.

Use of the FlowMeter permits control of intravascular pressure, pressure gradient and flow conditions with high accuracy. This enables in vitro studies on vessel segments under conditions very close to those found in vivo. Adding the FlowMeter to the Pressure Myograph System also enables measurement of flow rate as a parameter. The FlowMeter data will make it possible to record live traces of the flow dependent parameters as shear stress, Reynolds number and vascular resistance due to changes in vessel structure and function in various physiological and pharmacological studies.

To add the FlowMeter to the Pressure Myograph System the cable from the flow is attached to the “Flowmeter” port marked on the backside of the Pressure Interface. MyoVIEW will recognize the FlowMeter as soon as it is connected to the Pressure Interface and will be ready for use immediately. Please see the MyoVIEW video manuals linked in the help menu of MyoVIEW.

2.4.5 Connecting the oxygen supply

Connect the oxygen supply pipe on the Pressure Myograph chamber cover to an adjustable oxygen supply. See figure 2.2 and 2.3 for Pressure Myograph - 110P and Confocal Pressure Myograph - 120CP, respectively.

2.4.6 Connecting a suction device

Connect the “large” pipe on the Pressure Myograph chamber cover to a vacuum pump via a suction bottle and a vacuum valve as illustrated in figure 2.1. The internal diameter of the silicone tube used for this connection must be 2 mm. (a 2 mm tube is not included with the Pressure Myograph System).

CHAPTER 3 - PRESSURE INTERFACE MENUS

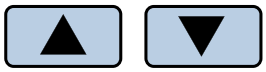
This chapter contains a detailed description of how to navigate the touch screen menus and how to use the special features of the Pressure Interface.

3.1 General description of how to navigate the touch screen

Menus on the Pressure Interface are all accessible by a touch screen. To access a menu, simply touch the screen. When a setting needs to be changed, press SELECT beside the line to be changed.

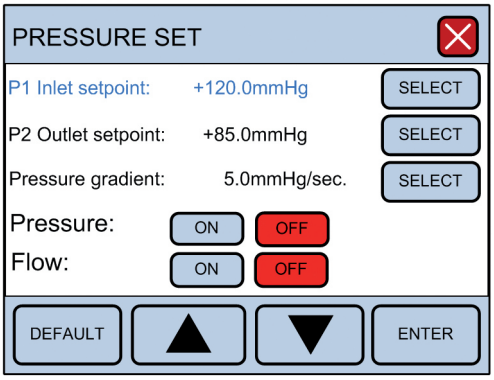
The line selected will turn blue, indicating that the Pressure Interface is in edit mode and waiting for input. When DEFAULT is chosen, a default value will be displayed.

To change the numeric value for the selected parameter touch the UP or DOWN arrows.



Once the desired setting has been chosen, pressing ENTER will save the selection, and the new value will be stored in memory. The selected line will turn black.

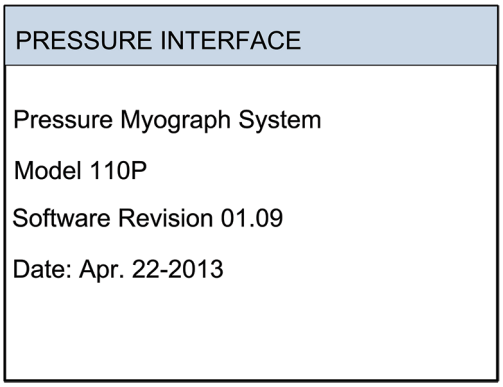
Pressing the white X in the red box will exit the menu and take you automatically to the **Main Menu**.



3.2 Power-up screen

After turning on the Pressure Interface, an introduction screen appears. It displays the software version number. While this screen is displayed the system is auto-initializing.

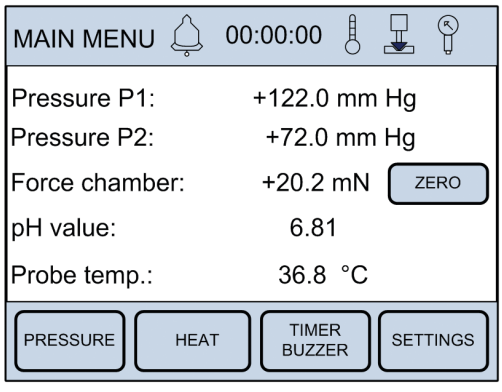
After a few seconds, the **Main Menu** display will appear.

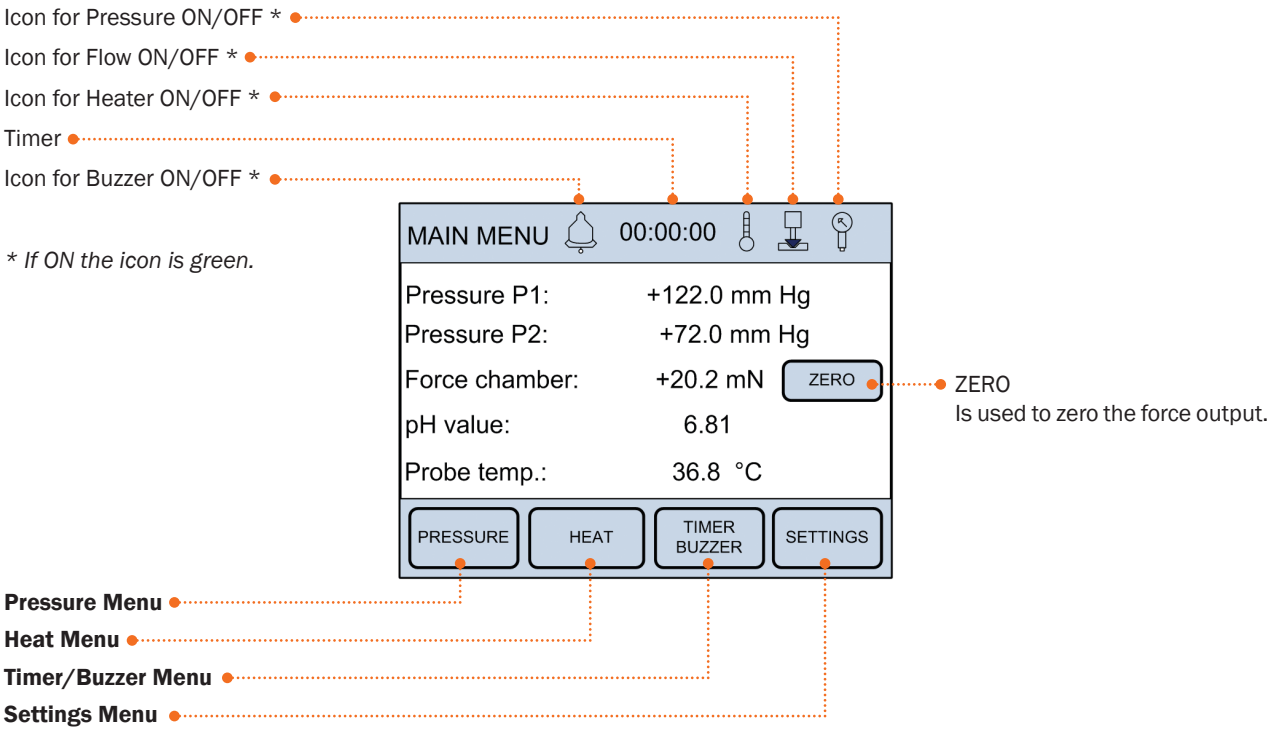


3.3 Main Menu

The **Main Menu** gives a good overall picture of how the Pressure Interface is working. It displays values for the input pressure, output pressure, force, pH, probe temperature and time, and the status of systems including the time, heat, flow and pressure. See next page for a description of the **Main Menu**.

Four sub-menus are accessible from the **Main Menu** screen:
Pressure Menu
Heat Menu
Timer and Buzzer Menu
Setting Menu





Buzzer icon:
This icon indicates the status on the buzzer.
If the icon is grey the buzzer is OFF.
If the icon is green the buzzer is ON (active) and will make a sound when the timer reaches zero.

Timer:
The Timer is a countdown timer that can be set to maximum 24 hours. If the Buzzer is activated it will buzz when the timer reach zero.

00:00:00

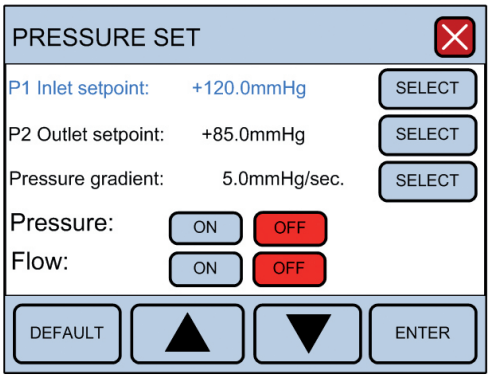
Heat icon:
This icon indicates the status of the chamber heat.
If the icon is grey the heat is OFF.
If the icon is green the heat is ON (active).

Flow valve icon:
This icon indicate the status on the flow valve.
If the icon is grey the flow valve is OFF (NO flow).
If the icon is green the flow valve is ON (active).

Pressure icon:
This icon indicates the status of the pressure regulation.
If the icon is grey the pressure regulation is OFF.
If the icon is green the pressure regulation is ON (active).

Zero:
Is used to zero the output from the force transducer. Pressing ZERO will reset the baseline of the chart traces without affecting the calibrations.

3.4 Pressure Menu

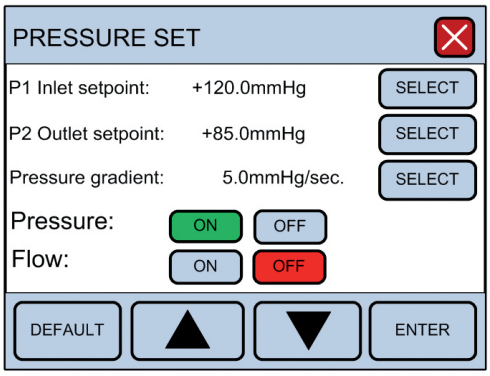


The pressure is controlled from this menu. Use SELECT to select the line to be changed. When selected the line changes to blue (edit mode). Use DEFAULT or UP and DOWN arrows to change the setpoint value. Pressing ENTER will save the new setpoint.

P1 Inlet setpoint is the pressure value that the regulator is setting on the inlet side of the Pressure Myograph. Pressure range is 0-250mmHg.
P2 Outlet setpoint is the pressure value that the regulator is setting on the outlet side of the Pressure Myograph. Pressure range is 0-250mmHg.

Pressure gradient set the speed at which the regulator modifies the pressure. The pressure change range is 1-10mmHg/sec.

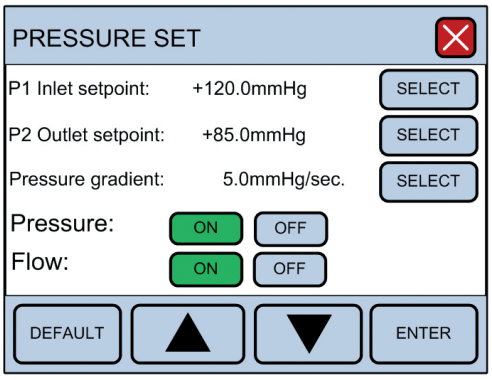
IMPORTANT
P1 INLET SETPOINT SHOULD BE HIGHER THAN P2 OUTLET SETPOINT TO CREATE FLOW. IF P1 INLET SETPOINT IS LOWER THAN P2 OUTLET SETPOINT IT WILL PREVENT BACKFLOW IN THE SYSTEM.



The pressure regulator and the flow are also controlled from this menu. To turn the pressure regulator on press ON outside the line for **Pressure**. When activated it turns green.

In **Main Menu** the pressure icon also turns green when pressure regulation is on.

ON

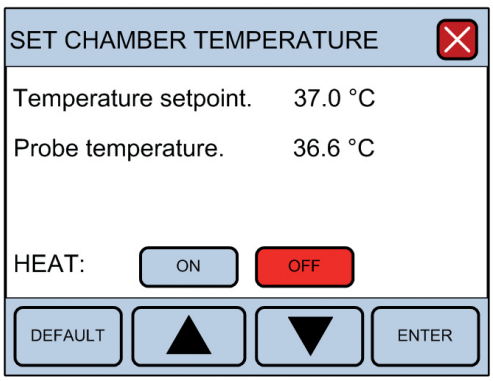


To turn the flow on press ON outside the line for **Flow**. When activated it changes green.

In **Main Menu** the flow icon also turns green when flow is on.

ON

3.5 Heat Menu

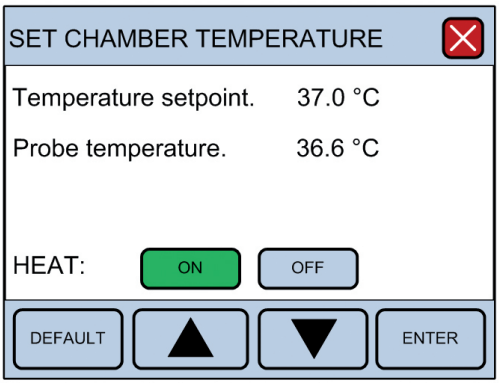


The chamber and bottle heating temperature are controlled from this menu. To turn the heat on, or to change the temperature for the system, press the HEAT in the **Main Menu.** The display will enter the **Heat Menu** and allow the user to change the system temperature, as well as turn heat on or off. Pressing DEFAULT will automatically reset the temperature setpoint to 37°C. Manually change the temperature by pressing the UP or DOWN arrows. Pressing ENTER will save the new temperature setpoint.

To turn the heat on, press ON and it will turn green. The system will heat to the desired temperature setpoint.

In **Main Menu** the thermometer icon turns green when the heat is on.

ON

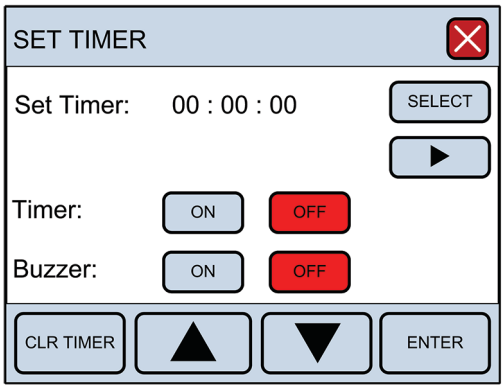


3.6 Timer and Buzzer Menu

The timer and buzzer are controlled from this menu.

Use SELECT to program the timer. The timer can be programmed in intervals from 0 to 23:59:59 (Hours : minutes : seconds). When **Set Timer** is selected press the UP and DOWN arrows to program the timer. The hours are programmed first, and then use the RIGHT arrow to get to the minutes and then the seconds.

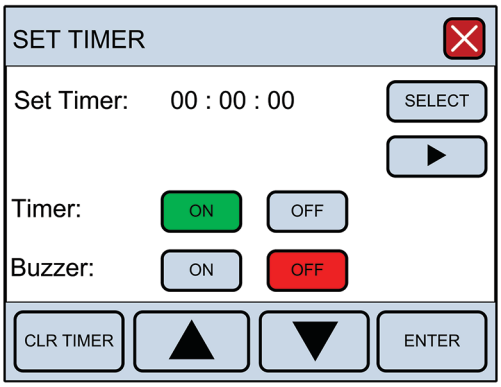
Pressing ENTER will save the programmed time.



To start the timer press the Timer ON and it will turn green.

When the timer reaches zero it automatically switches to **OFF**.

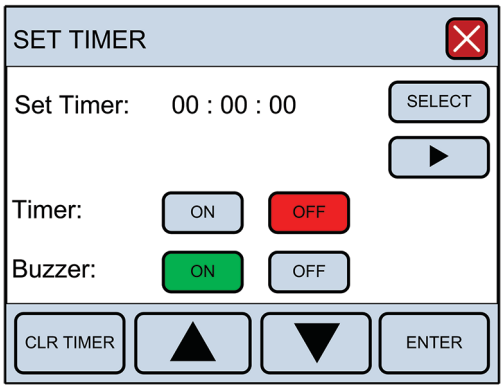
If the buzzer is set **ON** it will make a tone when the timer reaches zero.



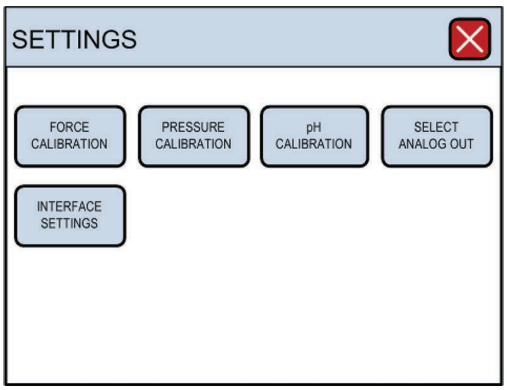
To activate the buzzer press ON and it will turn green.

In **Main Menu** the bell icon also turns green.

ON



3.7 Settings Menu



The **Settings Menu** contains several sub-menus. These sub-menus include:

Force Calibration
Pressure Calibration
pH Calibration (optional)
Select Analog Output
Interface Settings

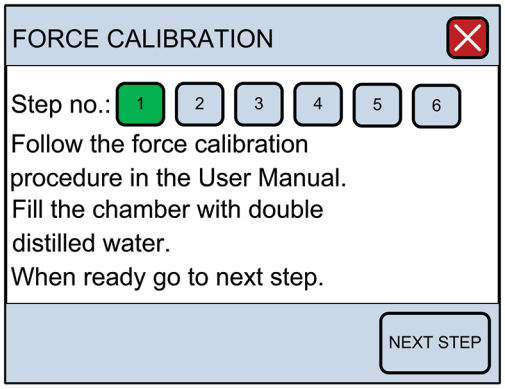
3.7.1 Force Calibration Menu

Prior to shipping the Pressure Myograph System has gone through two days of continuous testing, including final force calibrations. However, DMT recommends that new force calibrations are performed before starting to use the Pressure Myograph System for the first time. The calibration procedure needs to be performed to calibrate the system. Before starting the force calibration the following is performed. Please see figure 3.1 and 3.2 for Pressure Myograph - 110P or Confocal Pressure Myograph - 120CW, respectively.

Enter **Force Calibration Menu** by pressing **Settings** in the **Main Menu** and then press **Force Calibration Menu** to begin the transducer calibration. The display will show the force calibration procedure. The calibration procedure is listed in 6 individual steps and needs to be performed one at a time to calibrate the system.

Step 1 - Involves setting up the chamber for calibration. Fill the chamber with double-distilled water to a normal level and move the glass cannulas apart.

Press NEXT STEP.

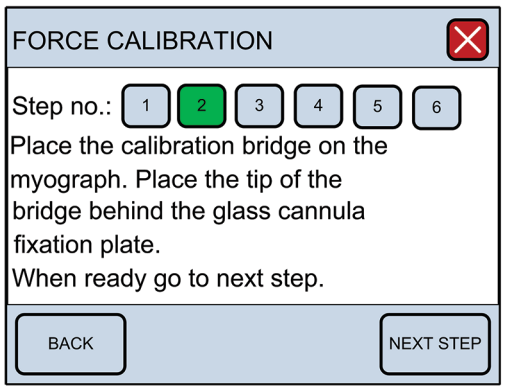

FORCE CALIBRATION
Step no.: 1 2 3 4 5 6
Follow the force calibration procedure in the User Manual.
Fill the chamber with double distilled water.
When ready go to next step.
NEXT STEP

Step 2 - Involves setting up the Calibration Kit for the actual force calibration.

Place the calibration bridge and T-balance on the Pressure Myograph allowing it to be pre warmed. Make sure that the tip of theT-balance pin is placed behind the glass cannula fixation plate as illustrated in figure 3.1 and 3.2 for Pressure Myograph - 110P or Confocal Pressure Myograph - 120CW, respectively. Carefully move the calibration bridge until the tip of the T-balance pin is placed freely and properly in place.

IMPORTANT
MAKE SURE NO FORCE IS APPLIED TO THE TRANSDUCER.

Press NEXT STEP.


FORCE CALIBRATION
Step no.: 1 2 3 4 5 6
Place the calibration bridge on the myograph. Place the tip of the bridge behind the glass cannula fixation plate.
When ready go to next step.
BACK
NEXT STEP

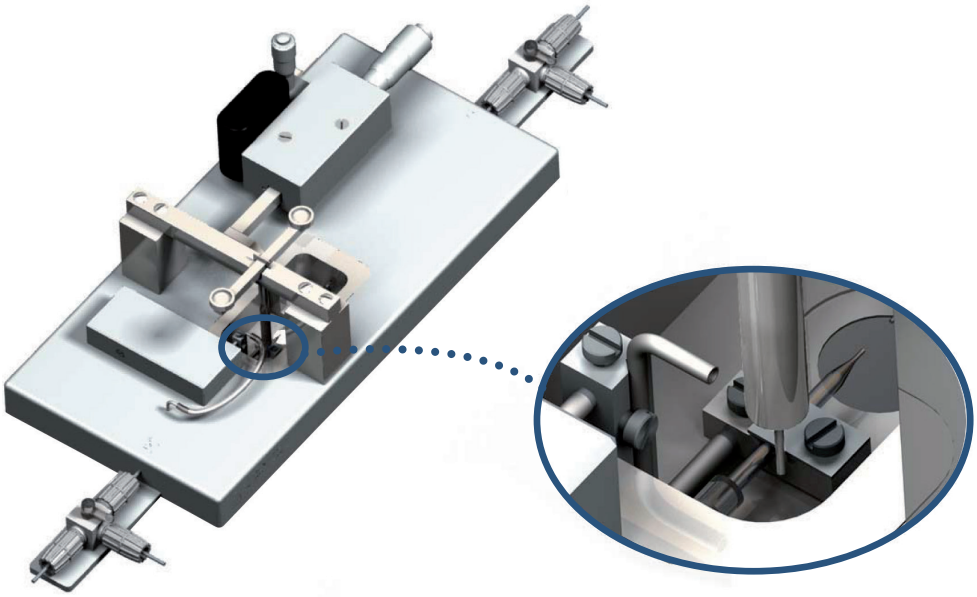


Figure 3.1 *- Illustration of how to fit the T-balance just behind the glass cannula fixation plate for 110P chamber*

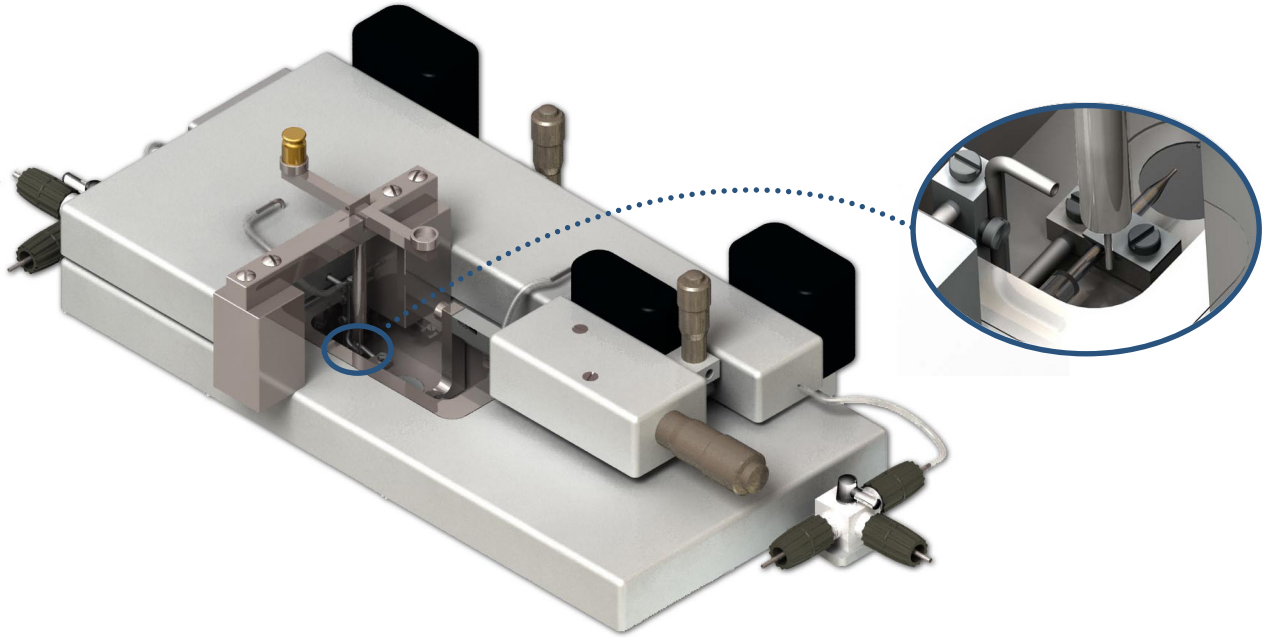
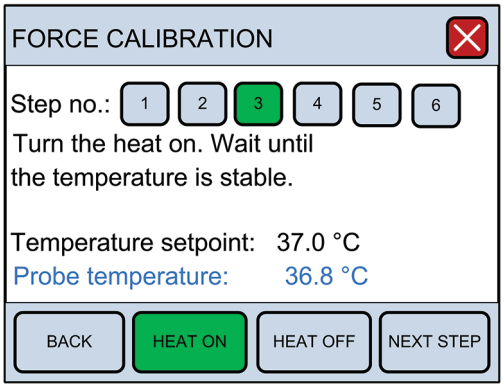


Figure 3.2 *Illustration of how to fit the T-balance just behind the glass cannula fixation plate for 120CP chamber*

Step 3 - This step initiates the heating process for the chamber. In order for the calibration to be accurate, the transducer must be heated to the same temperature as used in your experiments. This allows for heat-induced expansion of the electronic parts in the transducer. Otherwise, inaccurate readings and transducer drift may occur. To start heating, press HEAT ON.

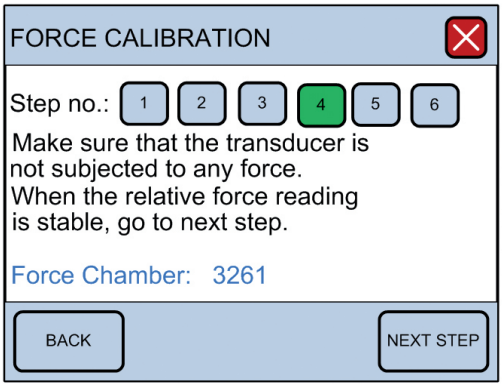
Covering the chamber with the chamber cover will expedite the heating. Place the temperature probe into the chamber for the first calibration to monitor when the chamber has reached the target temperature. After approximately 20-30 minutes the whole system will have reached the target temperature (normally 37° C).

Press NEXT STEP when the chamber are heated and have reached the target temperature.

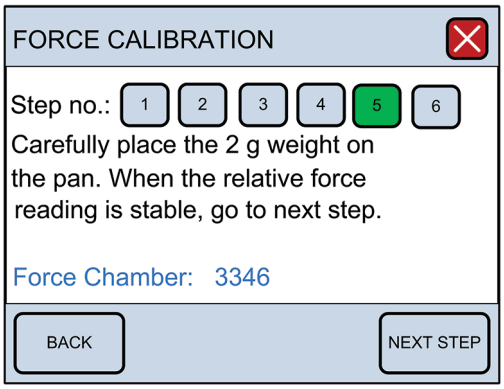


Step 4 - This is the first step in the actual force calibration process. A four digit number will be displayed in blue at the bottom of the screen. If nothing has been disturbed during the heating process, the zero/0 gram calibration should be stable. After 30 to 45 seconds the four digit number will not fluctuate. If the four digit number is not stable, please wait.

Press NEXT STEP


FORCE CALIBRATION
Step no.: 1 2 3 4 5 6
Make sure that the transducer is
not subjected to any force.
When the relative force reading
is stable, go to next step.
Force Chamber: 3261
BACK
NEXT STEP

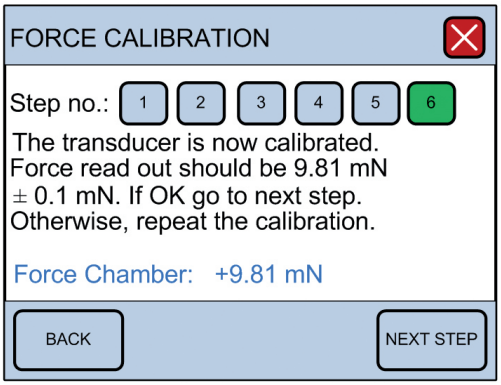
Step 5 - At this step, carefully place the 2 gram weight in the pan **closest to the transducer** (over the transducer) to simulate the stretch created by the contraction of a mounted muscle preparation.
Remember, a 2 gram weight in a 90° vector is divided, and the transducer will only detect 1 gram or 9.81 mN of force. The weight placement should cause a positive increase in the four digit number. Wait at least 30 to 45 seconds for the applied force to stabilize. Press NEXT STEP


FORCE CALIBRATION
Step no.: 1 2 3 4 5 6
Carefully place the 2 g weight on
the pan. When the relative force
reading is stable, go to next step.
Force Chamber: 3346
BACK
NEXT STEP

Step 6 - This step verifies that the calibration was performed correctly. The Force Chamber reading should be 9.81 ± 0.1 mN. If the Force Chamber reading is off by more than 0.1 mN, then remove the weight, press BACK to return to step 4, and repeat the calibration process.

Press NEXT STEP if the Force Chamber reading is satisfactory.

After calibrating the force transducer, carefully remove weight, T-balance and calibration bridge. The Pressure Myograph System is now ready for longitudinal force measurements.


FORCE CALIBRATION
Step no.: 1 2 3 4 5 6
The transducer is now calibrated.
Force read out should be 9.81 mN
± 0.1 mN. If OK go to next step.
Otherwise, repeat the calibration.
Force Chamber: +9.81 mN
BACK
NEXT STEP

3.7.2 Pressure Calibration Menu

3.7.2.1 Set-up the pressure calibration procedure

Press **Settings** in the **Main Menu** and then press **Pressure Calibration**. The set-up to perform the pressure transducer calibration procedure is illustrated in figure 3.3. Carefully follow the procedure described below to calibrate the Pressure Myograph System. The calibration procedure is listed in 5 individual steps and needs to be performed one at a time to calibrate the system.

Figure 3.3 *Illustration of set-up for pressure transducer calibration*

Pressure calibration procedure for Pressure Myograph 110P

1. Connect the Pressure Interface with the Pressure Myograph.
2. Connect the Big Ben Pressure Manometer to the 3-way valve at P1 on the Pressure Myograph as illustrated in figure 3.3.
3. Inside the Pressure Myograph chamber, on the right hand side, is a small stainless steel pipe, which is connected to the right glass cannula via a small silicone tube “B”, see figure 3.4. Carefully disconnect the silicone tube from the stainless steel pipe.
4. Carefully disconnect the silicone tube “A” between the “outlet connecting pipe” and the “outlet pressure transducer connecting pipe”, see figure 3.4.

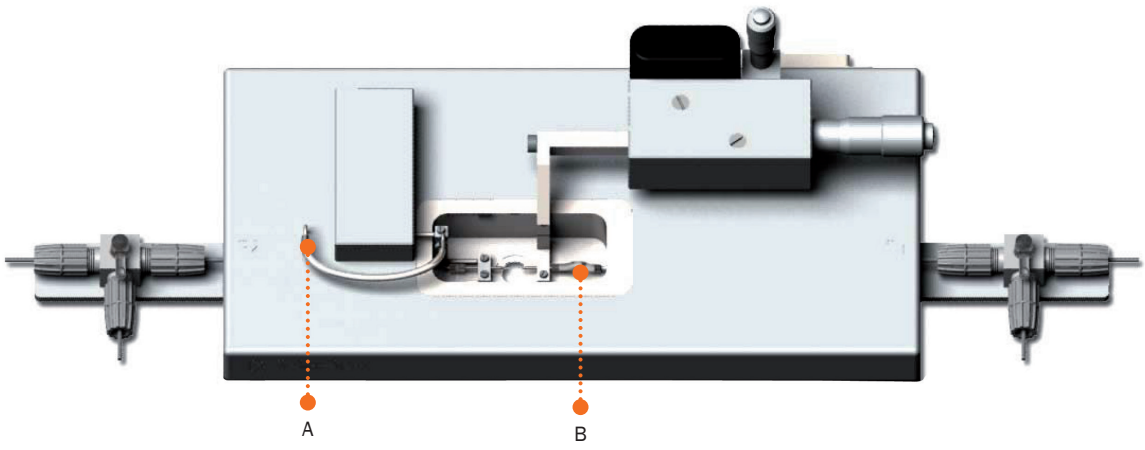


Figure 3.4 *Disconnection of silicone tubes for 110P*

5. Mount the enclosed calibration shunt (resistance tube) to the outlet connecting pipe “A” and the stainless steel pipe “B” as illustrated in figure 3.5.

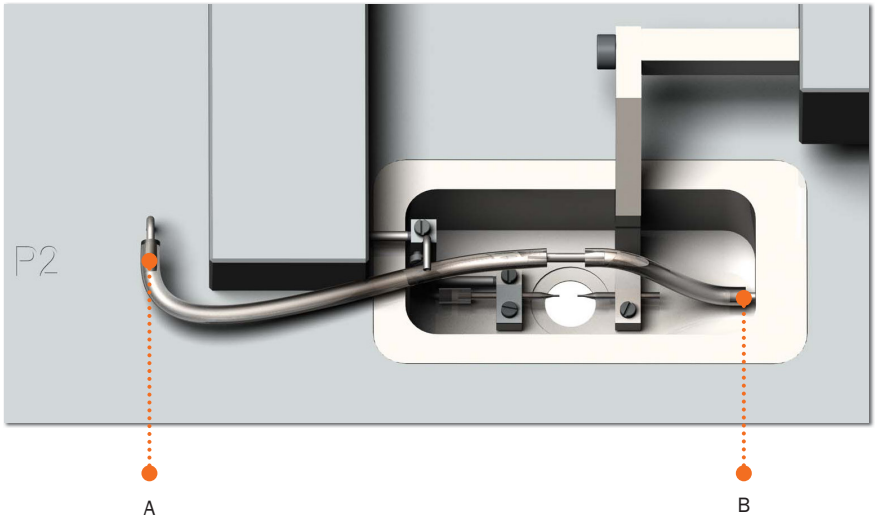


Figure 3.5 *Mounting of calibration shunt (resistance tube)*

6. Close the inlet from the Pressure Interface to P1 by turning the handle on the 3-way valve towards the normal inlet way, see figure 3.6. The inlet to P1 now comes from the pressure manometer and the Pressure Myograph system is now ready for a calibration procedure.

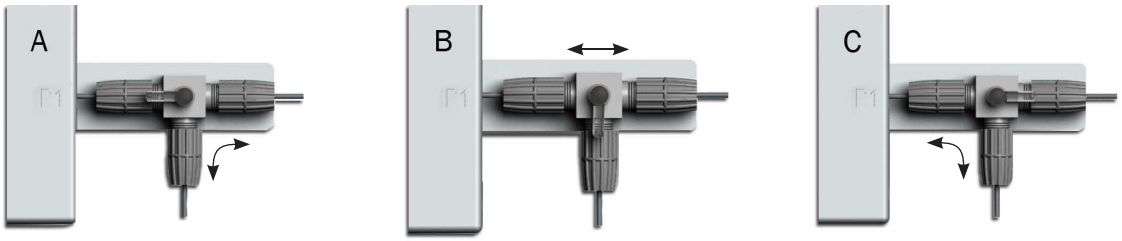


Figure 3.6 *Three-way valve flow settings at P1*

Pressure calibration procedure for Pressure Myograph 120CP

1. Connect the Pressure Interface with the Pressure Myograph.
2. Connect the Big Ben Pressure Manometer to the 3-way valve at P1 on the Pressure Myograph as illustrated in figure 3.3.
3. On the upper right side of the Pressure Myograph, a small stainless steel pipe is placed. It is connected to the right glass cannula via a small silicone tube “B”, see figure 3.7. Carefully disconnect the silicone tube from the stainless steel pipe.
4. Carefully disconnect the silicone tube “A” between the outlet connecting pipe and the “outlet pressure transducer connecting pipe”, see figure 3.7.

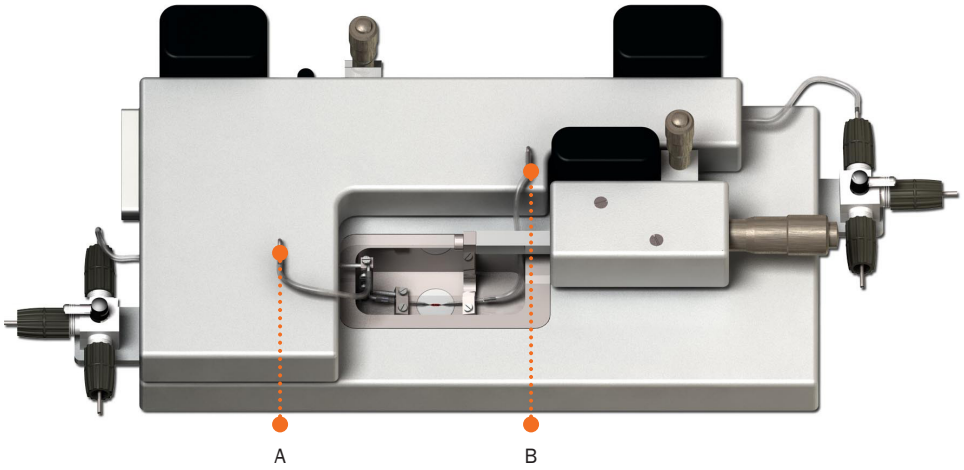


Figure 3.7 *Disconnection of silicone tubes for 120CP*

5. Mount the enclosed calibration shunt (resistance tube) to the outlet connecting pipe “A” and the stainless steel pipe “B” as illustrated in figure 3.8.

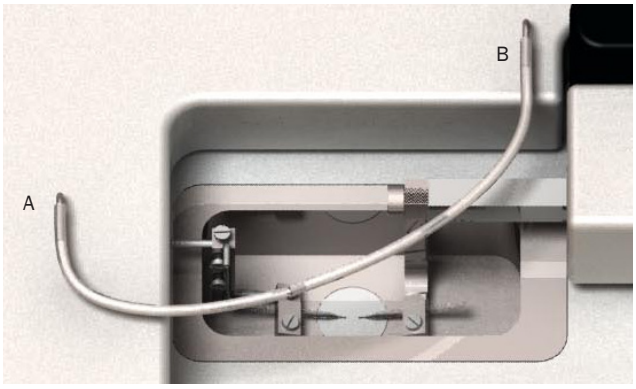
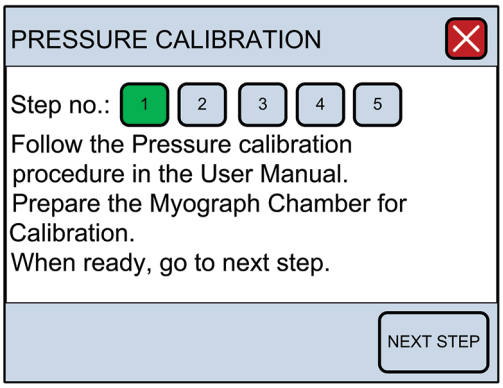


Figure 3.8 *Mounting of calibration shunt (Resistance tube)*

6. Close the inlet from the pressure regulator to P1 by turning the handle on the 3-way valve towards the normal inlet way, see figure 3.6. The inlet to P1 now comes from the pressure manometer and the Pressure Myograph system is now ready for a calibration procedure.

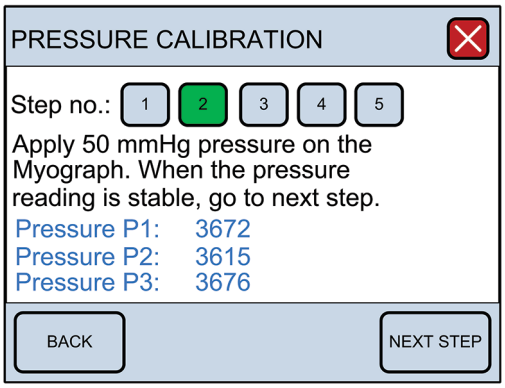
3.7.2.2 Set-up the pressure calibration on the Pressure Interface

Step 1 - Press NEXT STEP when the system is ready.


PRESSURE CALIBRATION
Step no.: 1 2 3 4 5
Follow the Pressure calibration procedure in the User Manual.
Prepare the Myograph Chamber for Calibration.
When ready, go to next step.
NEXT STEP

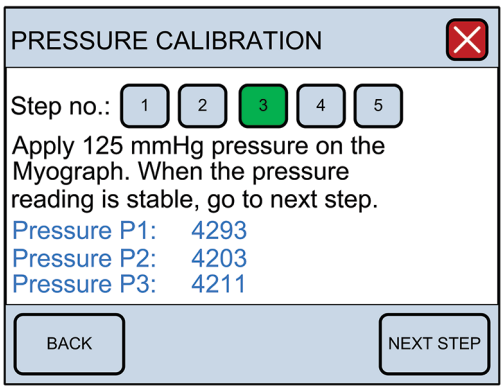
Step 2 - Apply a pressure of 50mm Hg on the Pressure Myograph using the Big Ben Pressure Manometer. When the 3 blue lines of relative values stabilize, go to NEXT STEP.

The relative values should be between 3300 to 3900.


PRESSURE CALIBRATION
Step no.: 1 2 3 4 5
Apply 50 mmHg pressure on the Myograph. When the pressure reading is stable, go to next step.
Pressure P1: 3672
Pressure P2: 3615
Pressure P3: 3676
BACK
NEXT STEP

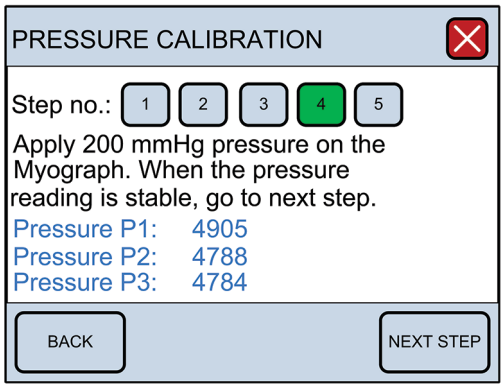
Step 3 - Apply a pressure of 125mm Hg to the Pressure Myograph using the Big Ben Pressure Manometer. When the 3 blue lines of relative values stabilize, go to NEXT STEP.

The relative values should be between 3900 to 4500.


PRESSURE CALIBRATION
Step no.: 1 2 3 4 5
Apply 125 mmHg pressure on the Myograph. When the pressure reading is stable, go to next step.
Pressure P1: 4293
Pressure P2: 4203
Pressure P3: 4211
BACK
NEXT STEP

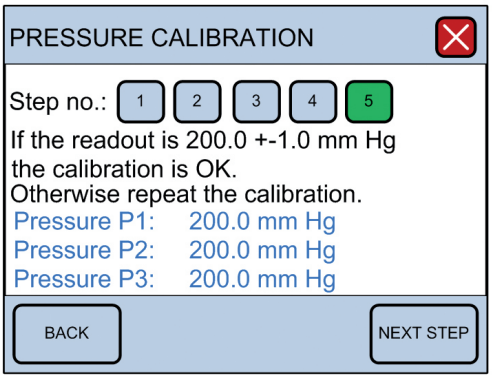
Step 4 - Apply a pressure of 200mm Hg to the Pressure Myograph using the Big Ben Pressure Manometer. When the 3 blue lines of relative values stabilize, go to NEXT STEP.

The relative values should be between 4600 to 5200.


PRESSURE CALIBRATION
Step no.: 1 2 3 4 5
Apply 200 mmHg pressure on the Myograph. When the pressure reading is stable, go to next step.
Pressure P1: 4905
Pressure P2: 4788
Pressure P3: 4784
BACK
NEXT STEP

Step 5 - The calibration is now finished. The readings in the three bottom lines are the actual pressure on all three pressure sensors. The values must be 200.0 +/-1.0mm Hg.

Carefully remove the calibration shunt tube and reconnect the tubing to the glass cannulas.

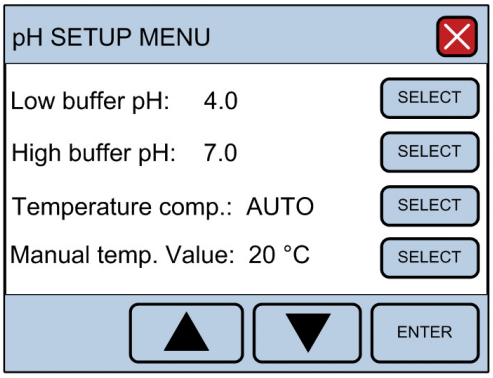

PRESSURE CALIBRATION
Step no.: 1 2 3 4 5
If the readout is 200.0 +-1.0 mm Hg
the calibration is OK.
Otherwise repeat the calibration.
Pressure P1: 200.0 mm Hg
Pressure P2: 200.0 mm Hg
Pressure P3: 200.0 mm Hg
BACK
NEXT STEP

3.7.3 pH Calibration Procedure (optional)

Before the pH calibration is performed be sure to select the way the pH electrode is to be used. See the sub-menu **pH Set-up** under **Interface Settings** (3.6.5.2 pH Set-up Menu).

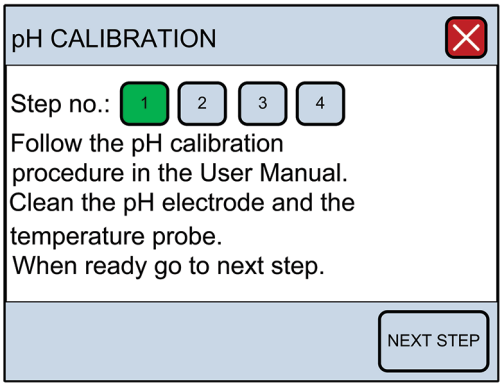
The temperature is an important parameter in the calibration formula and is obtained automatically if AUTO is selected in **Temperature compensation** function.

If **Manual** is selected, the manual temperature is used in the pH calibration formula, and the temperature probe is de-activated.
In the **Manual mode**, the temperature of the calibration buffers is measured with a thermometer and entered manually in the **Manual Temp. value** line.

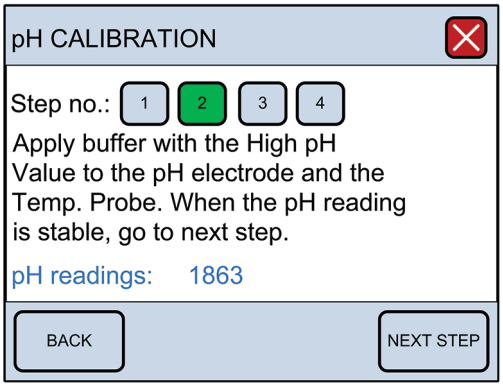


The pH calibration procedure is listed in 4 individual steps and needs to be performed one at a time.

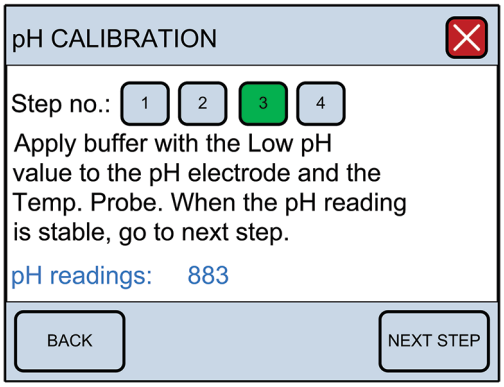
Step 1 - Step 1 involves cleaning the pH electrode and the temperature probe with double distilled water. When ready Press NEXT STEP.


pH CALIBRATION
Step no.: 1 2 3 4
Follow the pH calibration
procedure in the User Manual.
Clean the pH electrode and the
temperature probe.
When ready go to next step.
NEXT STEP

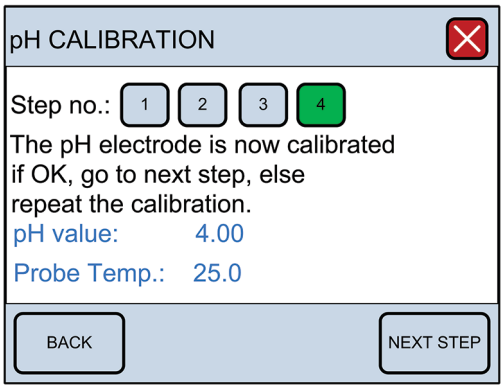
Step 2 - Place the pH electrode and temperature probe in the high buffer solution (here pH 7) and turn on stirring of the high buffer solution. When the relative pH output in the blue line is stable, go to NEXT STEP.


pH CALIBRATION
Step no.: 1 2 3 4
Apply buffer with the High pH
Value to the pH electrode and the
Temp. Probe. When the pH reading
is stable, go to next step.
pH readings: 1863
BACK
NEXT STEP

Step 3 - Place the pH electrode and temperature probe in the low buffer solution (here pH 4) and turn on stirring of the low buffer solution. When the relative pH output in the blue line is stable, go to NEXT STEP.


pH CALIBRATION
Step no.: 1 2 3 4
Apply buffer with the Low pH value to the pH electrode and the Temp. Probe. When the pH reading is stable, go to next step.
pH readings: 883
BACK
NEXT STEP

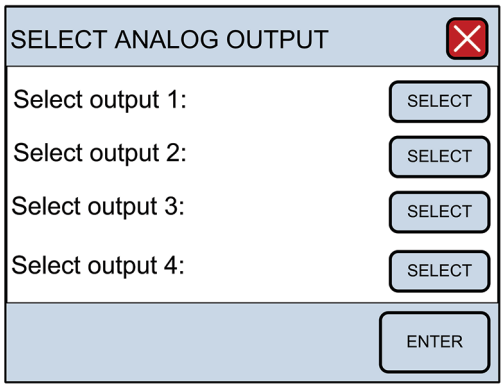
Step 4 - The calibration is now finished. The values in the two bottom lines are the actual pH and temperature reading.


pH CALIBRATION
Step no.: 1 2 3 4
The pH electrode is now calibrated if OK, go to next step, else repeat the calibration.
pH value: 4.00
Probe Temp.: 25.0
BACK
NEXT STEP

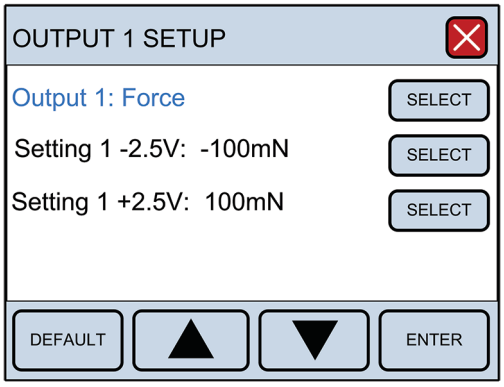
3.7.4 Select Analog Output (optional)

The **Analog Output Menu** determines which data is sent to the BNC analog outputs (REC 1, REC 2 REC 3, REC 4) at the back of the Pressure Interface, four in total. Each output is individually programmable. Any changes made to the analog output will only affect the data collected by the external data acquisition system. Therefore it is important to check the data acquisition setup when a change is made. The analog output works in range of -2,5V to +2,5V.

Use SELECT to select the channel number to be changed. Then press ENTER to go to the output set-up.



Use SELECT to select the line to be changed. Use Up and DOWN arrows or DEFAULT to change/select a new set-up.

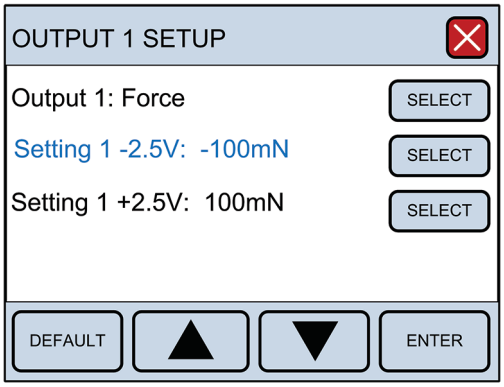


The following parameter in the Pressure Interface can be selected as output on the analog channel.

Force, probe temperature, chamber temperature, pH1, pressure regulation ON/OFF, Flow ON/OFF, (Optional: Digital output 1, Digital output 2, Digital input 1, Digital input 2), Pressure P1, Pressure P2.

When the parameter is selected press ENTER to save the value.

The output range is -2,5V to +2,5V. The user can select the parameter value that gives -2,5V and the value that gives +2,5V. In this example -100mN is -2,5V and +100mN is +2,5V. Selecting asymmetrical values is also valid. They can be -2,5V = 0mN and +2,5V = 100mN.

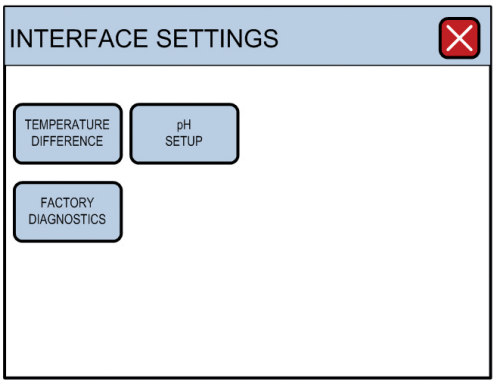


OBS
REMEMBER TO PRESS THE ENTER KEY TO SAVE THE LINE CHANGES TO MEMORY.

3.7.5 Interface settings

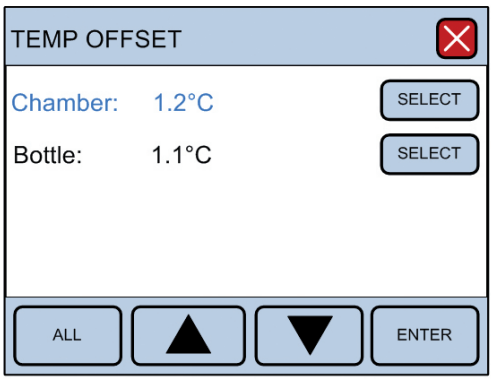
The **Interface Settings** sub-menu in **Settings** has an additional three sub-menus which include:

Temperature Difference
pH Set-up
Factory Diagnostics



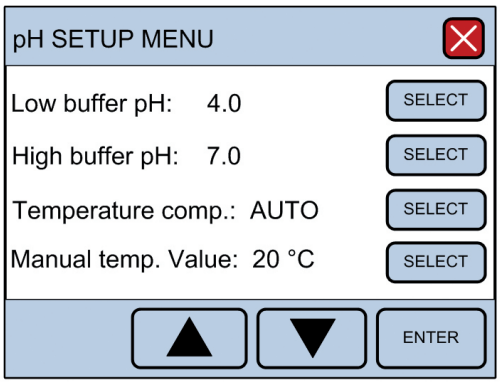
3.7.5.1 Temperature Difference (offset)

The temperature difference function allows the user to fine-tune the temperature setpoint of the system. Although the temperature setpoint for the system can be set in the **Heat Menu**, the actual temperature for the system may not heat to the exact setpoint. This function allows the user to adjust the temperature of the chamber and bottle individually so the exact temperatures can be reached. This is referred to as a temperature offset ("TEMP OFFSET" on chamber). Pressing SELECT or ALL have the same function in this menu as previously described. Pressing ENTER will save the values for future experiments.



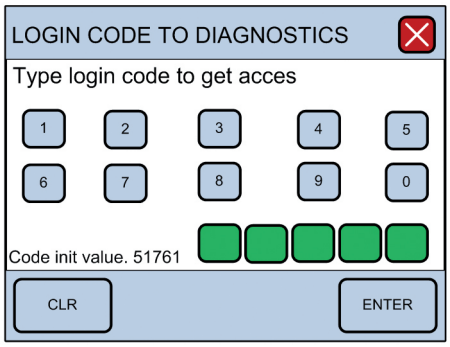
3.7.5.2 pH Set-up Menu

The temperature is an important parameter in the calibration formula and is obtained automatically if AUTO is selected in the temperature compensation, as shown below.
If MANUAL is chosen, the manual temperature is used in the pH calibration formula, and the temperature probe is deactivated.
In the MANUAL mode, the temperature of the calibration buffers is measured with a thermometer and entered manually in the **Manual temp. Value** line.



3.7.5.3 Factory Diagnostics

Entering **Factory Diagnostics** will display the **Login code to diagnostics** window. This window is for trained technicians and is used for diagnostics and troubleshooting purposes. The general user will not have access to this window. However, entering the proper five digit login code, will give the trained technician access to diagnostics panels that will provide information during a malfunction, or mechanisms to change other settings controlled by the onboard computer.



APPENDIX 1 - SYSTEM SPECIFICATIONS

Technical specifications - Pressure Interface

External 100-240VAC to 24VDC adapter:	±10%
Current max.:	3.3Amps at 24VDC.
Voltage:	100 to 240 VAC (auto) 50/60 Hz
Dimensions LxDxH in cm:	34 x 25 x 15
Net weight:	5 kg.
Environmental humidity:	20% to 80% RH, non-condensing.
Environmental operating temperature:	+15 to +40°C.
Environmental storage temperature:	+4 to +70°C.
Fluid capacity:	500 ml bottles. We recommend a volume of 400ml to ensure optimal pressure regulation.
One pH input range:	pH 0-14
pH calibration:	Manual with instructions on the display.
4 analog outputs:	BNC connectors at rear to connect to external data recorder.
Analog output range:	±2.5Volt.
Output impedance:	<200 Ohm.
Air connection:	Maximum pressure 1 Bar.
USB connector:	For downloading firmware and connection to PC.
Heating:	Built-in
Temp. range:	Ambient - 50°C
Temp. resolution:	0.1°C
Temp. probe:	Included
Ambient temperature:	15-30°C
Valves:	Safety and reduction

Technical specifications - Pressure Myograph - 110P/120CP

Vessel size:	>60 µm
Vessel alignment:	Manually X, Y & Z settings
Mounting supports:	Glass Canullas
Chamber:	Single
Chamber volumes:	Max. 10 ml (5 ml typical)
Chamber material:	Acid-resistant stainless steel
Chamber cover:	With pipes for suction/gassing/superfusion
Chamber temp. Resolution:	0.1°C.
Chamber temp. Stability:	+/- 0.2°C. (When target temperature attained).
Force calibration:	Manual with guidens on display.
Force range:	± 200 mN
Force resolution:	0.1 mN
Pressure range:	0 - 250 mmHg (requires external pressure source. app.1 ATO.)
Pressure resolution:	0.1 mmHg
Pressure calibration:	Manual with guidens on display.
Transducer data	
Maximum range:	±200mN.
Operating temperature:	+15 to +50°C.
Frequency range:	0 – 20Hz.

Optional accessories

FlowMeter - 162FM	
- range:	15 µl/min to 4000 µl/min
Enable pH meter on the interface:	
- range:	pH 0 - 14
- temp. correction:	20°C - 50°C
Peristaltic pump:	2.5 - 50 rpm (for superfusion of the chamber)

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